MACTEC ENVIRONMENTAL RESTORATION SERVICES, LLC

Spectral Gamma-Ray Borehole Log Data Report

Log Event A

Borehole 50-06-05

Borehole Information

Farm :	T	**Tank :**	T-106	**Site Number :**	299-W10-111
N-Coord :	43,511	**W-Coord :**	75,809	**TOC Elevation :**	671.37
Water Level, ft :	95.4	**Date Drilled :**	8/31/1973		

Casing Record

Type :	Steel-welded	Thickness, in. :	0.237	ID, in. :	4
Top Depth, ft. :	0	Bottom Depth, ft. :	122		
Type :	Steel-welded	Thickness, in. :	0.280	ID, in. :	6
Top Depth, ft. :	0	Bottom Depth, ft. :	122		

Cement Bottom, ft. : 122 **Cement Top, ft. :** 0

Borehole Notes:

Borehole 50-06-05 was drilled in August 1973 to a depth of 94 ft with 6-in. casing. Data from the drilling log and Chamness and Merz (1993) were used to provide borehole construction information. In May 1977, the borehole was deepened and the 6-in. casing was extended to a depth of 122 ft. The 6-in. casing was perforated from 0 to 20 ft, 81 to 110 ft, and 115 to 120 ft. A 4-in. casing liner with a metal cap welded on the bottom was positioned inside the 6-in. casing. Although no information concerning grouting was provided in the drilling log or Chamness and Merz (1993), it is assumed the entire annulus between the 4-in. and 6-in. casings was filled with grout because annular grouting was part of the procedure used during the 1977 campaign to deepen selected T Tank Farm boreholes. In addition, the logging engineer reported that grout was visible between the casings at the ground surface. The thicknesses of the 4-in. and 6-in. casings are presumed to be 0.237 in. and 0.280 in., respectively, on the basis of the published thickness for schedule-40, 4-in. and 6-in. steel tubing.

Equipment Information

Logging System :	2B	**Detector Type :**	HPGe	**Detector Efficiency:**	35.0 %
Calibration Date :	11/1997	**Calibration Reference :**	GJO-HAN-20	**Logging Procedure :**	MAC-VZCP 1.7.10-1

Logging Information

Log Run Number :	1	**Log Run Date :**	02/24/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	0.0	**Counting Time, sec.:**	200	**L/R :** L **Shield :**	N
Finish Depth, ft. :	32.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

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Log Run Number :	2	**Log Run Date :**	02/24/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	31.0	**Counting Time, sec.:**	200	**L/R :** R	**Shield :** N
Finish Depth, ft. :	54.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	3	**Log Run Date :**	02/25/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	53.0	**Counting Time, sec.:**	200	**L/R :** R	**Shield :** N
Finish Depth, ft. :	107.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a
Log Run Number :	4	**Log Run Date :**	02/26/1998	**Logging Engineer:**	Alan Pearson
Start Depth, ft.:	118.5	**Counting Time, sec.:**	200	**L/R :** R	**Shield :** N
Finish Depth, ft. :	106.0	**MSA Interval, ft. :**	0.5	**Log Speed, ft/min.:**	n/a

Logging Operation Notes:

This borehole was logged by the SGLS in four log runs using a 200-s counting time. The top of the borehole casing, which is the zero reference for the SGLS, is approximately flush with the ground surface. The total logging depth achieved was 118.5 ft.

High dead time (greater than 40 percent) was encountered during log run one at a depth of 32 ft. As a result, log runs two, three, and four were logged in real time from 31 to 118.5 ft.

Analysis Information

Analyst : E. Larsen

Data Processing Reference : MAC-VZCP 1.7.9 Analysis Date : 07/06/1998

Analysis Notes :

The pre-survey and post-survey field verification for each logging run met the acceptance criteria established for peak shape and system efficiency. The energy calibration and peak-shape calibration from the accepted calibration spectrum that most closely matched the field data were used to establish the peak resolution and channel-to-energy parameters used in processing the spectra acquired during the logging operation.

This borehole was completed with 4-in.- and 6-in.-diameter casings along the entire logged interval. A casing correction factor for a 0.50-in.-thick steel casing was applied to the concentration data because it most closely matched the 0.517-in. total combined thickness of the 4-in. and 6-in. casings. The entire annulus between the 4-in. and 6-in. casings is filled with grout, making accurate calculation of radionuclide concentrations impossible. However, man-made and natural radionuclides were identified and apparent concentrations are reported.

Approximately 23 ft of water has collected inside the bottom of this borehole. The appropriate water correction factor was not available, so no compensation was applied to the water-filled interval. This resulted in lower reported man-made and natural radionuclide concentration values between 95.5 and 118.5 ft.

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Log Plot Notes:

Separate log plots show the man-made and the naturally occurring radionuclides. The natural radionuclides can be used for lithology interpretations. The headings of the plots identify the specific gamma rays used to calculate the concentrations. Uncertainty bars on the plots show the estimated uncertainties for the measurements as 95-percent confidence intervals. Open circles on the plots give the MDL. The MDL of a radionuclide represents the lowest concentration at which positive identification of a gamma-ray peak is statistically defensible.

A combination plot includes the man-made and natural radionuclides, the total gamma derived from the spectral data, and the Tank Farms gross gamma log. The gross gamma plot displays the latest available digital data. No attempt has been made to adjust the depths of the gross gamma logs to coincide with the SGLS data.

A time-sequence plot of the historical gross gamma log data from 1975 to 1994 is presented with the SGLS log plots. A plot that compares the decay rate of the historical gross gamma data with the calculated decay curves for specific radionuclides is also included.

Results/Interpretations:

The radionuclide concentrations identified in this section are reported as only apparent concentrations and are underestimated.

Detector saturation occurred from 33 to 67.5 ft and 69 to 93 ft. As a result, no spectral data were collected along these regions of the borehole. Zones of high dead time (greater than 90 percent) occurred from 98.5 to 106 ft and 112 to 117.5 ft. Although the accuracy of the radioassays collected within these intervals is limited, the spectra were reviewed and found to be usable for radioassay calculations and are included on the log plot. A zone of very high dead time (98 to 99.9 percent) occurred from 106.5 to 111.5 ft. Accurate radioassays could not be determined from the limited spectral data collected within this interval; consequently, these data were not included on the log plot.

The man-made radionuclides Cs-137 and Co-60 were detected by the SGLS. The Cs-137 contamination was measured continuously from the ground surface to 32.5 ft, 93.5 to 106 ft, and from 112 ft to the bottom of the logged interval. A small zone of Co-60 contamination was detected from 93.5 to 95.5 ft. An isolated occurrence of Co-60 was detected at 97.5 ft.

The K-40 and Th-232 concentration values are absent from about 32 ft to the bottom of the logged interval. The U-238 concentrations are absent from 1.5 to 2 ft and from 28 ft to the bottom of the logged interval.

Additional information and interpretations of log data are included in the main body of the Tank Summary Data Report for tank T-106.